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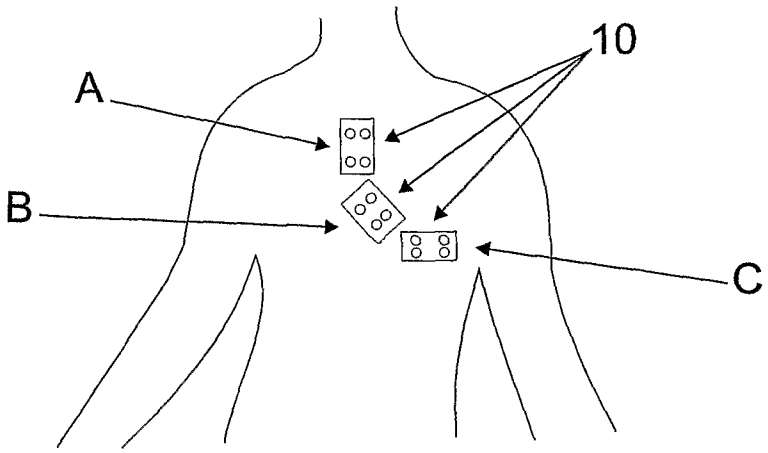
(54) **Title:** APPARATUS FOR SENSING AND PROCESSING ELECTRICAL CARDIAC SIGNALS AND METHOD OF REMOTE SENSING AND PROCESSING OF ELECTRICAL CARDIAC SIGNALS



(57) Abstract: The present invention relates to an apparatus (10) for sensing and processing electrical cardiac signals, said apparatus (10) comprising a plurality of electrical signal sensing electrodes (20a, 20b, 20c, 2Od, 2Oe) associated with an electronic processing circuit (30) , said electrical signal sensing electrodes (20a, 20b, 20c, 2Od, 2Oe) being consecutively arranged on a main body (11) and according to a determined sequence for sensing electrical signals; the main body (11) being associable with body surfaces of frontal portions of users' anterior limbs and wherein at least one electrode for sensing electrical signals (20a, 20b, 20c, 2Od, 2Oe) is digitally contactable; said electrical signals sensed from the heart being transmitted and processed by the electronic processing circuit (30) arranged on the main body (11) so that the electrical signals are selectively transformed into ECG bipolar, unipolar and unipolar precordial leads. Also disclosed is a method of remote sensing and processing of electrical cardiac signals by means of an apparatus (10) for sensing and processing electrical cardiac signals, said apparatus (10) comprising a plurality of electrical signal sensing electrodes (20a, 20b, 20c, 2Od, 2Oe) associated with an electronic processing circuit (30) , said method comprising the step of : A) Positioning the apparatus (10) associated with a body surface of a frontal portion of a user' s anterior limb so that a first electrical signal sensing electrode (20a) , arranged on the main body (11) of the apparatus (10) is directed to a user's left leg and positioning a first finger of the user over a third electrode for sensing electrical signals (20c) and a second finger of the user over a forth electrode for sensing electrical signals (2Od) , said first and second fingers originating from different hands.

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"APPARATUS FOR SENSING AND PROCESSING ELECTRICAL CARDIAC SIGNALS AND METHOD OF REMOTE SENSING AND PROCESSING OF ELECTRICAL CARDIAC SIGNALS"

The present invention relates to an apparatus for sensing and processing electrical cardiac signals for ECG, enabling its use by lay users because of simple and compact design, and to a method of remote sensing and processing of electrical cardiac signals which, by means of said apparatus for sensing and processing cardiac signals, enables a lay user to obtain his/her own heart signals or those of other persons and send them to a remote processing unit ready for generating the ECG graph.

Description of the Prior Art

Different types of electrocardiographs and cardiac monitors are known in the art and, in this sense, a great deal of work has been developed to simplify these pieces of equipment without losing the accuracy and reliability of the signals obtained and processed.

It is known that electrocardiographs are devices that detect electrical signals associated with the activity of the heart in order to produce electrocardiograms (ECG), which basically consist of a graphical record of the electrical voltage as a function of time. Therefore, an ECG consists of a non-invasive medical diagnostic method widely used in the follow-up of cardiac pathologies and routine examinations.

The first enhancements to the electrocardiographs date from 1872, and currently a great deal of effort is put into the development of increasingly simpler, portable and personal pieces of equipment enabling their use by the users/patients themselves outside the hospital environment.

Typically, the record of the heart's electrical activity is made through electrodes or sensors placed on specific points of the user's body surface. These electrodes sense the sequences of electrical events occurring in the cardiac cycle (systoles and diastoles) and which propagate to the body surface, these events later being processed and extracted into ECG graphs.

For sensing these electrical cardiac signals, predetermined

points are respected on which said electrodes should be positioned. This distribution of electrodes at predetermined points is known as lead, and usual leads are bipolar leads, unipolar leads and unipolar precordial leads. For each type of lead, a certain number of electrodes is used and arranged on different positions. Thus, traditional electrocardiographs formed by wires with sensors or electrodes at one of their ends are widely used, these electrodes being positioned on the user in the following manner: two electrodes on the arm, one electrode on the left leg and six electrodes distributed on the thoracic cavity. A simpler variation of this traditional method uses three wires with electrodes on one of the ends and two or four more electrodes (depending on the model) housed on the surface of the apparatus.

Because of the excessive quantity of wires used in traditional electrocardiographs, two color codes have been assigned in an attempt to standardize and simplify the handling of these wires. In the first code, the following colors are used: red, green and yellow, and handling should be done as follows: green on the waist region of the patient's left side; red on the right hand, wrist and axilla; yellow on the left hand, wrist and axilla. In the second code, the following colors are used: white, black and red, and handling should be done as follows: red on the waist region of the patient's left side; white on the right hand, wrist or axilla and black on the left hand, wrist or axilla. With regard to the sensors on the surface of the apparatus, they are positioned on the patient's thorax in three positions that vary from the center of the thorax to the left lateral region, next to the ribs.

An inconvenience presented by these traditional electrocardiographs consists of the large amount of color-coded wires used, requiring a trained professional skilled in performing the examination, thus avoiding the use of these pieces of equipment by lay users. This becomes a problem in the case of an emergency wherein the patient to be treated is not in a hospital environment, for instance, in case the patient has cardiac complications at home, these devices cannot be used by those accompanying the patient to identify the reasons for his/her indisposition. This leads to the need for urgent removal of the patient to a hospital and a relative delay until the heart

problem is actually detected and confirmed.

Another disadvantage is in the lower durability of the wires in relation to the other components of the equipment, requiring extra handling. Furthermore, the inadequate handling of the wires increases the incidences of noise and interference in the sensing of the signal, which may affect the quality of the data sensed as well as the ECG graph obtained.

Objects of the Invention

The present invention has as its object to provide a compact and simple apparatus for sensing and processing electrical cardiac signals, which can be used by lay users / patients, enabling the sensing of electrical cardiac signals and the selective transformation thereof into several existing leads (bipolar, unipolar and unipolar precordial) in order to obtain ECG graphs. Therefore, a user or patient is able to sense his/her own electrical cardiac signals at the smallest sign of alteration or discomfort and transform them into the pertinent leads to be later transmitted to the hospital environment where, in a fast and effective way, an ECG graph is generated, avoiding major health complications to this patient.

It is a further object of this invention to provide a method of remote sensing and processing of the electrical cardiac signals which, by means of said apparatus for sensing and processing electrical cardiac signals, enables the sensing and transformation of electrical signals, as well as their transmission to remote processing units to generate ECG graphs.

Brief Description of the Invention

The invention has as its object an apparatus for sensing and processing electrical cardiac signals, the apparatus comprising a plurality of electrical signal sensing electrodes associated with an electronic processing circuit, said apparatus being characterized in that:

(i) the electrical signal sensing electrodes are consecutively arranged on a main body and according to a determined sequence for sensing electrical signals;

(ii) the main body is associable with body surfaces of frontal portions of users' anterior limbs and wherein at least one electrode for sensing

electrical signals is digitally contactable; and

(iii) said electrical signals sensed from the heart are transmitted and processed by the electronic processing circuit arranged on the main body, so that the electrical signals are selectively transformed into ECG bipolar, unipolar leads and unipolar precordial leads.

A further object of the invention is a method of remote sensing and processing of electrical cardiac signals by means of an apparatus for sensing and processing electrical signals from the heart, said apparatus comprising a plurality of electrical signal sensing electrodes associated with an electronic processing circuit, said method comprising the steps of:

A) Positioning the apparatus associated with a body surface of a frontal portion of a user's anterior limb so that a first electrical signal sensing electrode, arranged on the main body of the apparatus is directed to a user's left leg and positioning a first finger of the user over a third electrode for sensing electrical signals and a second finger of the user over a forth electrode for sensing electrical signals, said first and second fingers originating from different hands;

B) Sensing of electrical signals originating from the user's heart and transmitting these signals to the electronic processing circuit;

C) Processing the electrical signals sensed by the electrical signal sensing electrodes and selectively transforming these electrical signals into ECG bipolar, unipolar or unipolar precordial leads; and

D) Transmitting the ECG bipolar, unipolar or unipolar precordial leads to at least one processing unit.

Brief Description of the Drawings

The present invention will be further described in more details based on one example of execution represented in the drawings. The figures show:

Figure 1 is a schematic view of the apparatus for sensing and processing electrical cardiac signals object of this invention;

Figure 2 is a schematic view of the positioning of the apparatus for sensing and processing electrical cardiac signals illustrated in Figure 1;

Figure 3 is a block diagram illustrating the sensing and transformation of signals obtained by the apparatus for sensing and processing electrical cardiac signals object of this invention; and

Figure 4 is an electronic schematic view of the electronic processing circuit that comprises the apparatus for sensing and processing electrical cardiac signals object of this invention.

Detailed Description of Drawings

According to a preferable embodiment, and as can be seen in Figure 1, apparatus 10 for sensing and processing electrical cardiac signals comprises a plurality of electrodes for sensing electrical signals 20a, 20b, 20c, 2Od, 2Oe, consecutively positioned on a contact surface 12 of a main body 11, in accordance with a determined sequence for sensing electrical signals. In particular, the arrangement of these electrodes is done clockwise, starting with a first electrode 20a following in order until a fifth electrode 2Oe; however, other different arrangements may be adopted, provided the apparatus 10 retains its functionality.

The electrodes for sensing electrical signals 20a, 20b, 20c, 2Od, 2Oe are associated with an electronic processing circuit 30, as illustrated in Figures 4 and 5.

This electronic processing circuit 30 comprises instrumentation amplifiers 31 (AD620), particularly used to measure analog signals of low amplitude originating from remote sources, since they are optimized to operate in situations wherein signal acquisition is difficult. Its function in this circuit is to define the needed leads and, for the present invention, it has the following main characteristics:

- Gain of up to 10^3 with the change of only one resistor (Rg);
- Symmetrical feed: 2.3V to 18V; and
- CMRR: 73 to 13O dB.

The instrumentation amplifiers 31 are associated with the electrodes for sensing electrical signals 20a, 20b, 20c, 2Od, 2Oe, in pairs and receive from them the sensed electrical cardiac signals. The instrumentation amplifiers 31 are also associated with a switching device 32, this switching

device being an analog multiplex (ADG608), for instance, which by means of a binary code (digital command) makes the selection of a certain lead to be analyzed. The function of an analog multiplex is to make the distribution of channels along a frequency range and, for the present invention, this switching device 32 has preferably eight inputs and one output, the inputs being determined by three addressable bits, as shown in the Table 1 below:

TABLE 1

A2	A1	A0	Input	Output
X	X	X	0	0
0	0	0	1	1
0	0	1	1	2
0	1	0	1	3
0	1	1	1	4
1	0	0	1	5
1	0	1	1	6
1	1	0	1	7
1	1	1	1	8

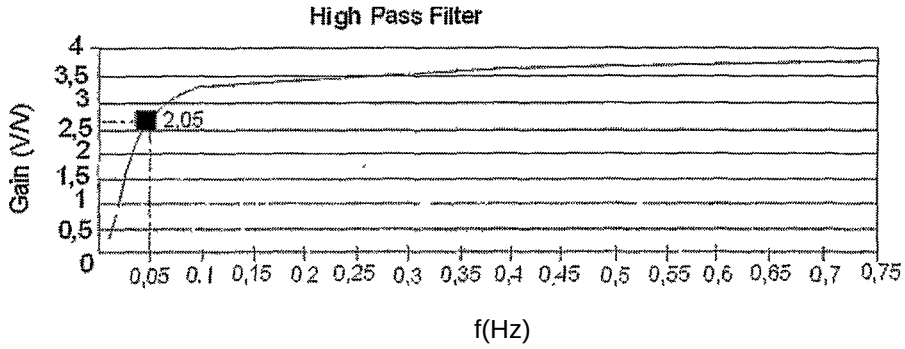
Completing the electronic processing circuit 30, the switching device 32 is associated with a filter block 33. For low amplitude signals, active filters are used, hence, in the electronic processing circuit 30 of the present invention, the forth-order "Butterworth" topology is adopted, which works at low frequency and also confers a gain to the system. Therefore, this circuit 30 was implemented with three active filters 33a, 33b, 33r interconnected in cascade resulting in a filter block with a frequency range of 0.05Hz to 150Hz, rejecting the 60Hz frequency, as illustrated in Figure 3. The filters 33a, 33b, 33r used in the preferable embodiment of this invention are of the LM324 type, having four operational amplifiers integrated into a same silicon chip enabling the use of printed circuit board of small size. Therefore, the filter block 33 comprises a high pass filter 33a with a determined frequency of fc = 0.05Hz; a low pass filter 33b with a determined frequency of fc = 150Hz; and a band reject filter 33r with a determined frequency of fc = 60Hz.

To determine the cutoff frequency of the high pass filter 33a the following analysis is carried out: output voltage of the plateau equals 828mV,

input voltage equals 22OmV → corresponding gain of 3.76 V/V. Thus, by dividing this value by √2, one finds the value of the gain corresponding to the cutoff frequency of the filter, confirming the cutoff frequency of 0.05Hz, as illustrated in Table 2 and Graph 1 below.

Table 2 - High Pass Filter

High Pass Filter (fc = 0.05Hz)			
Frequency (Hz)	Voltage		Gain (V/V)
	Input (mV)	Output (mV)	
0.01	212	72	0.33
0.03	224	400	1.78
0,05	220	584	2,65
0,07	220	668	3,03
0,1	220	736	3,34
0,5	220	828	3,76
1	220	828	3,76
5	220	828	3,76
50	220	828	3,76
500	220	828	3,76

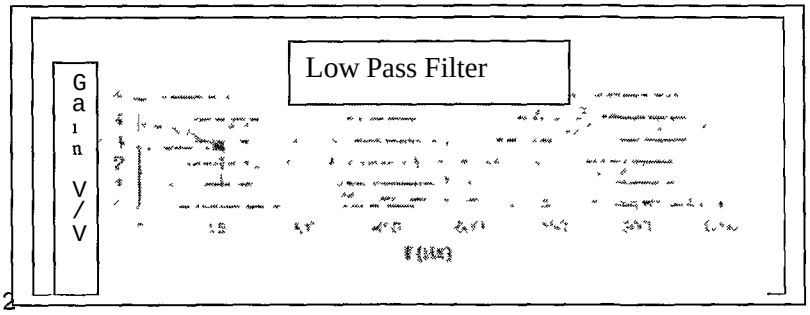


Graph 1

By making the same analysis, it is confirmed that the low pass filter 33b has a cutoff frequency of 150Hz, since the output voltage of the plateau equals 828mV, the input voltage equals 22OmV → corresponding gain of 3.81 VA/. Thus, by dividing this value by √2, one finds the value of the gain corresponding to the cutoff frequency of the filter, as illustrated in Table 3 and Graph 2 below.

Table 3 - Low Pass Filter

Low Pass Filter (fc = 150Hz)			
Frequency (Hz)	Voltage		Gain (V/V)
	Input (mV)	Output (mV)	
0,5	220	840	3,81
1	220	840	3,81
8	220	840	3,81
15	220	840	3,81
35	220	820	3,81
55	220	808	3,72
85	220	760	3,67
100	220	736	3,45
115	220	692	3,14
125	220	672	3,05
135	220	636	2,89
140	220	620	2,81
143	220	612	2,78
148	220	600	2,72
150	220	596	2,7
153	220	584	2,65
165	220	544	2,47
175	220	512	2,32
185	220	480	2,18
200	220	436	1,98
300	220	204	0,92
400	220	104	0,47
500	220	64	0,29
800	220	44	0,2
1000	220	40	0,18



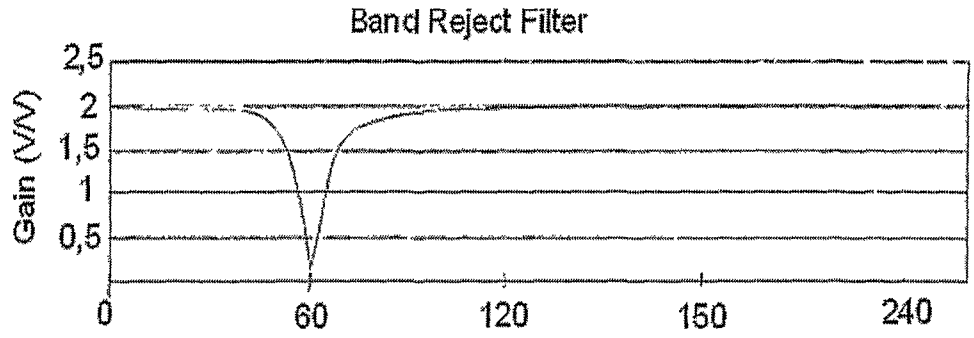
Graph 2

Graph 2

Once again, the same analysis is done to confirm that the band reject filter 33r should have a cutoff frequency of 60Hz, as illustrated in Table 4 and Graph 3 below.

Table 4 -

Band Reject Filter (fc = 60Hz)			
Frequency (Hz)	Voltage		Gain (V/V)
	Input (mV)	Output (mV)	
1	2,12	4,28	3,81
6	2,12	4,3	3,81
10	2,12	4,28	3,81
25	2,12	4,24	3,81
35	2,12	4,2	3,81
45	2,12	3,96	3,72
50	2,12	3,58	3,67
55	2,12	2,58	3,45
57	2,12	1,78	3,14
59	2,12	0,82	3,05
60	2,12	0,36	2,89
61	2,12	0,6	2,81
63	2,12	1,54	2,78
67	2,12	2,8	2,72
70	2,12	3,32	2,7
73	2,12	3,62	2,65
75	2,12	3,74	2,47
80	2,12	3,94	2,32
90	2,12	4,08	2,18
100	2,12	4,18	1,98
250	2,12	4,28	0,92
500	2,12	4,28	0,47
800	2,12	4,28	0,29
1000	2,12	4,28	0,2



Graph 3

The ECG signals sensed by the electrical signal sensing electrodes 20a, 20b, 20c, 2Od, 2Oe and transformed by the electronic processing circuit 30 are received by the receiver of the sensed ECG signal 35 to be later sent to a processing unit 40.

Figure 4 shows the scheme for sensing electrical cardiac signals containing 12 (twelve) leads.

It should be noted that the electrical signal sensing electrodes 20a, 20b, 20c, 20d, 2Oe and the electronic processing circuit 30 are arranged inside the main body 11 of the apparatus 10; however, the dimensions of said apparatus 10 are reduced, which makes it more practical and easy to handle and facilitates the use of its functions, which will be described in detail below.

The use of the apparatus 10 for sensing and processing electrical cardiac signals occurs with the association of the main body 11 of said apparatus 10 with body surfaces of frontal portions of users' anterior limbs, that is, by placing the contact surface 12 of the main body 11 in contact with the frontal portions of the users' anterior limbs, which consist of the user's thorax or abdomen, such as illustrated in Figure 2. In addition, at least one and preferably two of the electrical signal sensing electrodes 20a, 20b, 20c, 20d, 2Oe are digitally contactable, by means of the contact of the user's fingers with these electrodes, as will be further described.

With this positioning of the main body 11 of the apparatus 10, the electrical cardiac signals sensed by the electrical signal sensing electrodes 20a, 20b, 20c, 2Od, 2Oe are received and processed by an electronic processing circuit 30, so that the electrical signals are selectively transformed into ECG bipolar, unipolar or unipolar precordial leads. At the end of the

processing and transformation, the electrical signals pass to a receiver of the sensed ECG signal 35 and are later transmitted to a processing unit 40 via communication protocols and telephone routes, through transmission means.

The present invention also relates to a method of remote sensing and processing of electrical cardiac signals which, by means of said apparatus 10 for sensing and processing electrical cardiac signals described above, enables to remotely obtain electrical cardiac signals of a user or patient, transform these signals into pertinent leads to prepare an ECG graph and send them to a processing unit 40, where they will be converted into ECG graphs. Therefore, this method comprises the steps of:

A) Positioning the apparatus 10 associated with a body surface of a frontal portion of a user's anterior limb so that a first electrical signal sensing electrode 20a, arranged on the main body 11 of the apparatus 10 is directed to a user's left leg and positioning a first finger of the user over a third electrode for sensing electrical signals 20c and a second finger of the user over a forth electrode for sensing electrical signals 2Od, said first and second fingers originating from different hands;

B) Sensing of electrical cardiac signals originating from the user's heart and transmitting these signals to the electronic processing circuit 30;

C) Processing the electrical cardiac signals sensed by the electrical signal sensing electrodes 20a, 20b, 20c, 20d, 2Oe and selectively transforming these electrical signals into ECG bipolar, unipolar or unipolar precordial leads; and

D) Transmitting the ECG bipolar, unipolar or unipolar precordial leads to at least one processing unit 40.

In step A, the contact surface 12 of the main body 11 of the apparatus 10 for sensing and processing electrical signals is put into contact with the body surface of the user's thoracic cavity or abdomen.

The advantage provided by the apparatus 10 for sensing and processing electrical cardiac signals and by the method of remote sensing and processing electrical cardiac signals, which are the objects of the pre-

sent invention, consists of enabling the obtainment of three classical leads Dl, DII and Dili, as well as three augmented leads aVF, aVR and aVL, with only one positioning of the main body 11 of the apparatus 10 on a determi¬ned region of the patient's body.

Furthermore, although there is a need to place the main body 11 of the apparatus 10 for sensing and processing electrical cardiac signals in three different positions on the body surface of the user's thoracic cavity or abdomen to obtain the signals and transform them into the precordial leads, as shown in Figure 2, still the practicality of said apparatus 10 and the easy obtainment of the desired leads with a lower number of positionings render it superior to similar apparatuses known in the art.

With regard to the positions illustrated in Figure 2, with the main body 11 arranged on the first position A, two leads are acquired, such leads being V1 and V2; on the second position B, leads V3 and V4 are acquired and, finally, on the third position C, leads V5 and V6 are acquired.

Therefore, the positioning of the apparatus 10 for the desired sensing, regardless of the type of lead to be obtained, is done by placing the contact surface 12 of the main body 11 of the apparatus 10 associated, or in contact, with a body surface of a frontal portion of a user's anterior limb, more precisely in contact with the abdomen so that the first electrode for sen¬sing electrical signals 20a is directed to the user's left leg. Then, the user places his/her left hand thumb over the third electrode for sensing electrical signals 20c and then places the right hand thumb 20c over the forth electro¬de for sensing electrical signals 2Od. The other fingers of the user's hands are positioned on a ground point (no illustrated) of the apparatus 10.

Once the apparatus 10 is positioned, step B starts with the sen¬sing of electrical signals from the user's heart, which is done according to a timing programmed by the electronic processing circuit 30, that is, by means of this timing it is possible to control the time in which each signal will be analyzed.

In step C, the processing of the electrical signals sensed by elec¬trodes for sensing electrical signals 20a, 20b, 20c, 2Od, 2Oe is done by the

electronic processing circuit 30.

In this sense, and as already mentioned, the processing of the electrical signals sensed starts with the reception of the signals sensed by the electrodes for sensing electrical signals 20a, 20b, 20c, 2Od, 2Oe and by the instrumentation amplifiers 31 that define the desired or determined leads.

From the instrumentation amplifiers 31, the signals pass to a switching device 32, which selectively selects the lead to be analyzed. The sensed, analyzed and distributed signals are then passed to the filter block 33 and, after passing by the high pass filter 33a, low pass filter 33b and band reject filter 33r, the conditioned signals are sent to the receiver of the sensed ECG signal 35, ending step C of the present method.

After step C, already in step D of the method, there is the transmission of the ECG bipolar, unipolar our unipolar precordial leads by transmission means via communication protocols and telephone routes. This transmission occurs from the receiver of the sensed ECG signal 35 to the processing unit 40 and can be done via mobile or fixed telephone network, among other similar means.

After step D, the processing unit 40 transforms the leads into ECG graphs.

The advantages of the apparatus 10 for sensing and processing electrical cardiac signals and the method of remote sensing and processing of electrical cardiac signals, objects of the present invention, lie in that they may be used by laypersons with little guidance, such as with telephone guidance, for instance. Furthermore, the apparatus 10 is very practical because it does not need accessories, such as sets of wires and contact tips (hooks or alligator clips), which increases the durability of the apparatus 10. Another advantage observed is the reduction of noise and interferences in the sensing of the signal.

Having described examples of the invention with reference to its preferred embodiments, it is to be understood that the scope of the present invention embraces other possible variations, being limited solely by the appended claims, including the possible equivalents therein.

CLAIMS

1. An apparatus (10) for sensing and processing electrical cardiac signals, said apparatus (10) comprising a plurality of electrical signal sensing electrodes (20a, 20b, 20c, 2Od, 2Oe) associated with an electronic processing circuit (30), said apparatus (10) being characterized in that:

(i) the electrical signal sensing electrodes (20a, 20b, 20c, 2Od, 2Oe) are consecutively arranged on a main body (11) and according to a determined sequence for sensing electrical signals;

(ii) the main body (11) is associable with body surfaces of frontal portions of users' anterior limbs and wherein at least one electrode for sensing electrical signals (20a, 20b, 20c, 2Od, 2Oe) is digitally contactable; and

(iii) said electrical signals sensed from the heart are transmitted and processed by the electronic processing circuit (30) arranged on the main body (11) so that the electrical signals are selectively transformed into ECG bipolar, unipolar and unipolar precordial leads.

2. An apparatus, according to claim 1, characterized in that the electrical signal sensing electrodes (20a, 20b, 20c, 2Od, 2Oe) are positioned on a contact surface (12) of a main body (11) clockwise from a first to a fifth electrode for sensing electrical signals (20a, 20b, 20c, 20d, 2Oe).

3. An apparatus, according to claim 1, characterized in that the electronic processing circuit (30) comprises instrumentation amplifiers (30) associated with a switching device (32) which, in turn, is associated with a filter block (33).

4. An apparatus, according to claim 3, characterized in that the instrumentation amplifiers (31) are further associated with the electrodes for sensing electrical signals (20a, 20b, 20c, 2Od, 2Oe).

5. An apparatus, according to claims 1 to 4, characterized in that the electrodes for sensing electrical signals (20a, 20b, 20c, 2Od, 2Oe) and the electronic circuit (30) are arranged inside the main body (11).

6. An apparatus, according to claim 5, characterized in that it comprises transmission means of the electrical signals sensed by the electrodes for sensing electrical signals (20a, 20b, 20c, 2Od, 2Oe) and processed

by the electronic circuit (30) via communication protocols and telephone routes.

7. An apparatus, according to claim 1, characterized in that the frontal portions of the users' anterior limbs consist of the thorax or abdomen.

8. A method of remote sensing and processing of electrical cardiac signals by means of an apparatus (10) for sensing and processing electrical cardiac signals, said apparatus (10) comprising a plurality of electrical signal sensing electrodes (20a, 20b, 20c, 2Od, 2Oe) associated with an electronic processing circuit (30), said method being characterized in that it comprises the steps of:

A) Positioning the apparatus (10) associated with a body surface of a frontal portion of a user's anterior limb so that a first electrical signal sensing electrode (20a), arranged on the main body (11) of the apparatus (10) is directed to a user's left leg and positioning a first finger of the user over a third electrode for sensing electrical signals (20c) and a second finger of the user over a forth electrode for sensing electrical signals (2Od), said first and second fingers originating from different hands;

B) Sensing of electrical signals originating from the user's heart and transmitting these signals to the electronic processing circuit (30);

C) Processing the electrical signals sensed by the electrical signal sensing electrodes (20a, 20b, 20c, 2Od, 2Oe) and selectively transforming these electrical signals into ECG bipolar, unipolar or unipolar precordial leads; and

D) Transmitting the ECG bipolar, unipolar or unipolar precordial leads to at least one processing unit (40).

9. A method, according to claim 8, characterized in that, in step A, the main body (11) of the apparatus (10) for sensing and processing electrical signals is put into contact with the body surface of the user's thoracic cavity or abdomen.

10. A method, according to claim 9, characterized in that in step A there is a single positioning of the main body (11) of the apparatus (10).

11. A method, according to claim 9, characterized in that in step A there are multiple positionings of the main body (11) of the apparatus (10).

12. A method, according to claim 10 or 11, characterized in that in step A the other fingers of the user's hand are positioned on a ground point of the apparatus (10).

13. A method, according to claim 8, characterized in that, in step B, the sensing of the user's electrical cardiac signals occurs according to a timing programmed by the electronic processing circuit (30).

14. A method, according to claim 8, characterized in that, in step C, the processing of the sensed electrical signals is done by the electronic processing circuit (30).

15. A method, according to claim 13, characterized in that the processing of the sensed electrical signals is done by the reception of the sensed signals by instrumentation amplifiers (31) defining the leads, the instrumentation amplifiers (31) being associated with a switching device (32), which selectively selects the lead to be analyzed, said switching device (32) being associated with a filter block (33), which provides ECG signal conditioning, which is received by a receiver element of the sensed ECG signal (35).

16. A method, according to claim 8, characterized in that, in step D, the transmission of ECG bipolar, unipolar or unipolar precordial leads is done by transmission means via communication protocols and telephone routes.

17. A method, according to claim 8, characterized in that, after step D, the processing unit (40) transforms the leads into ECG graphs.

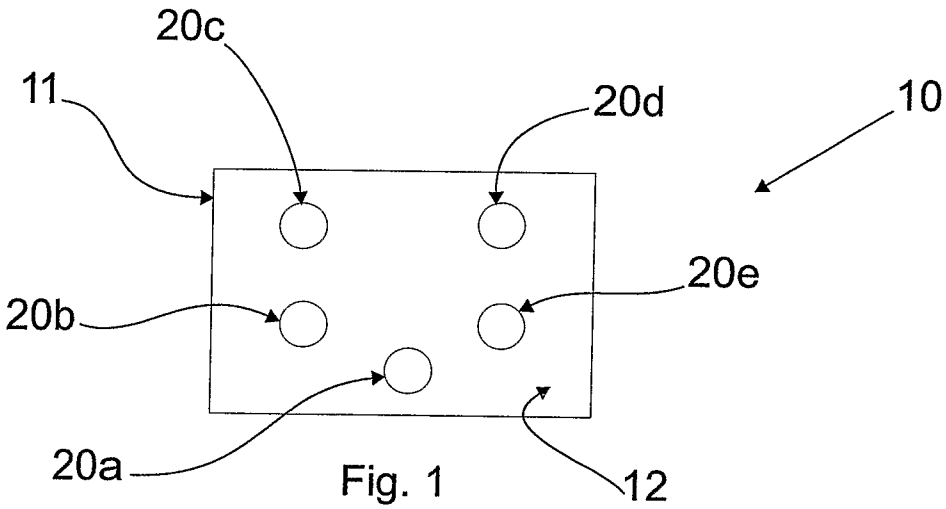


Fig. 1

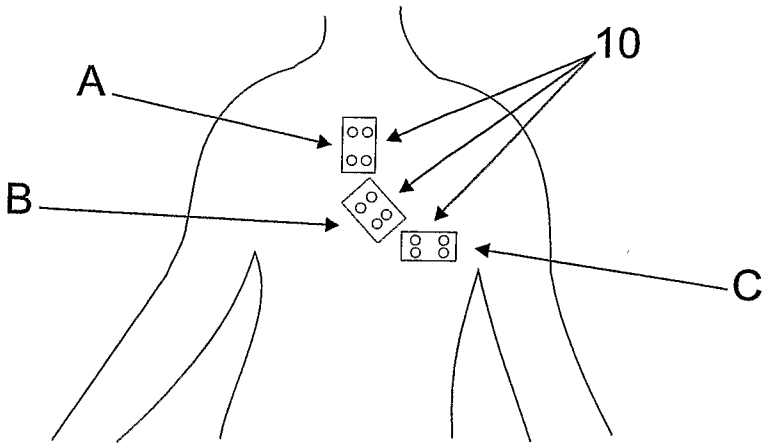
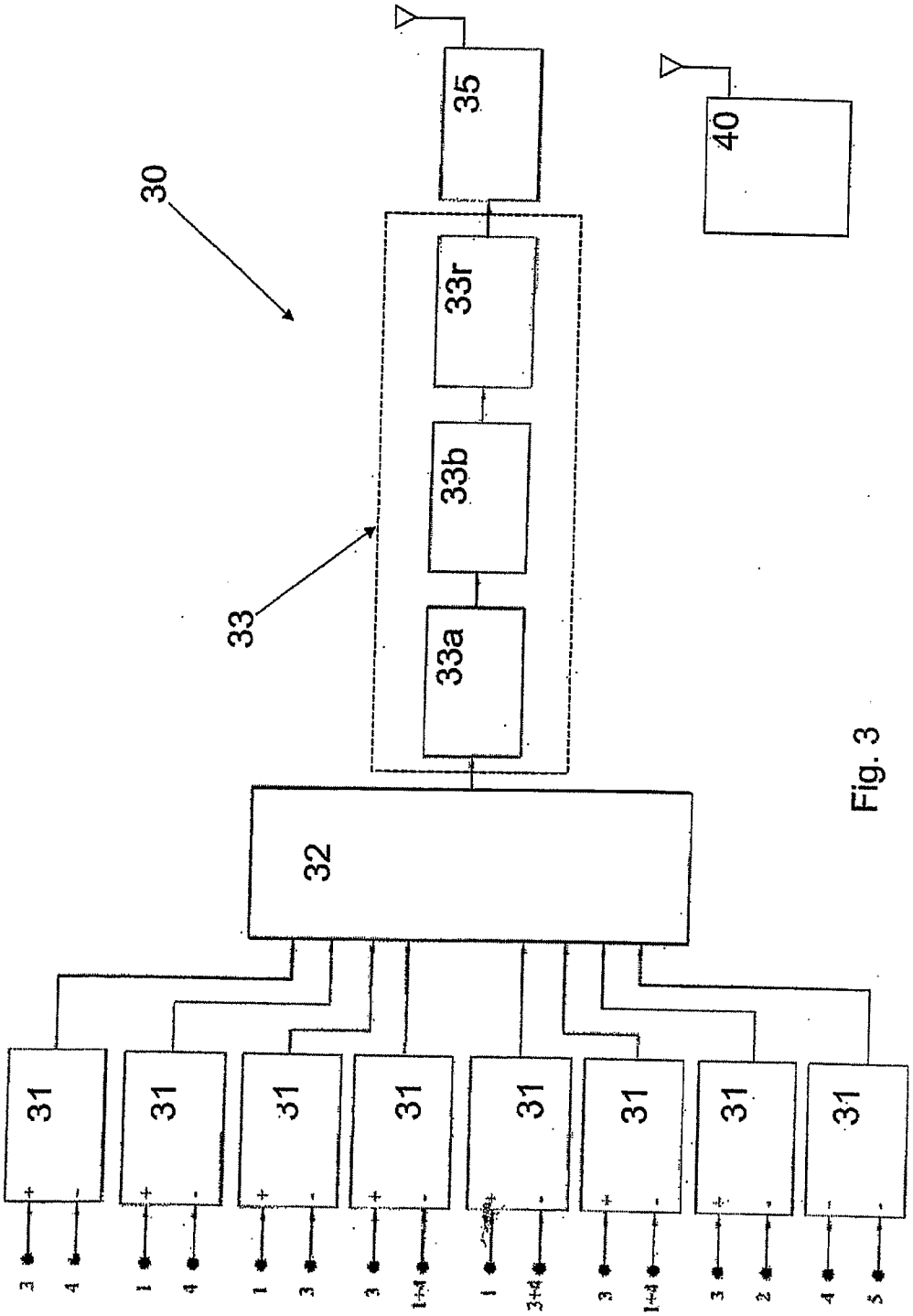


Fig. 2


30
33
35
40
33r
33b
33a
32
31
31
31
31
31
31
31
31
3
4
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4
1
3
3
1+4
1
3+4
3
1+4
3
2
4
5

Fig. 3

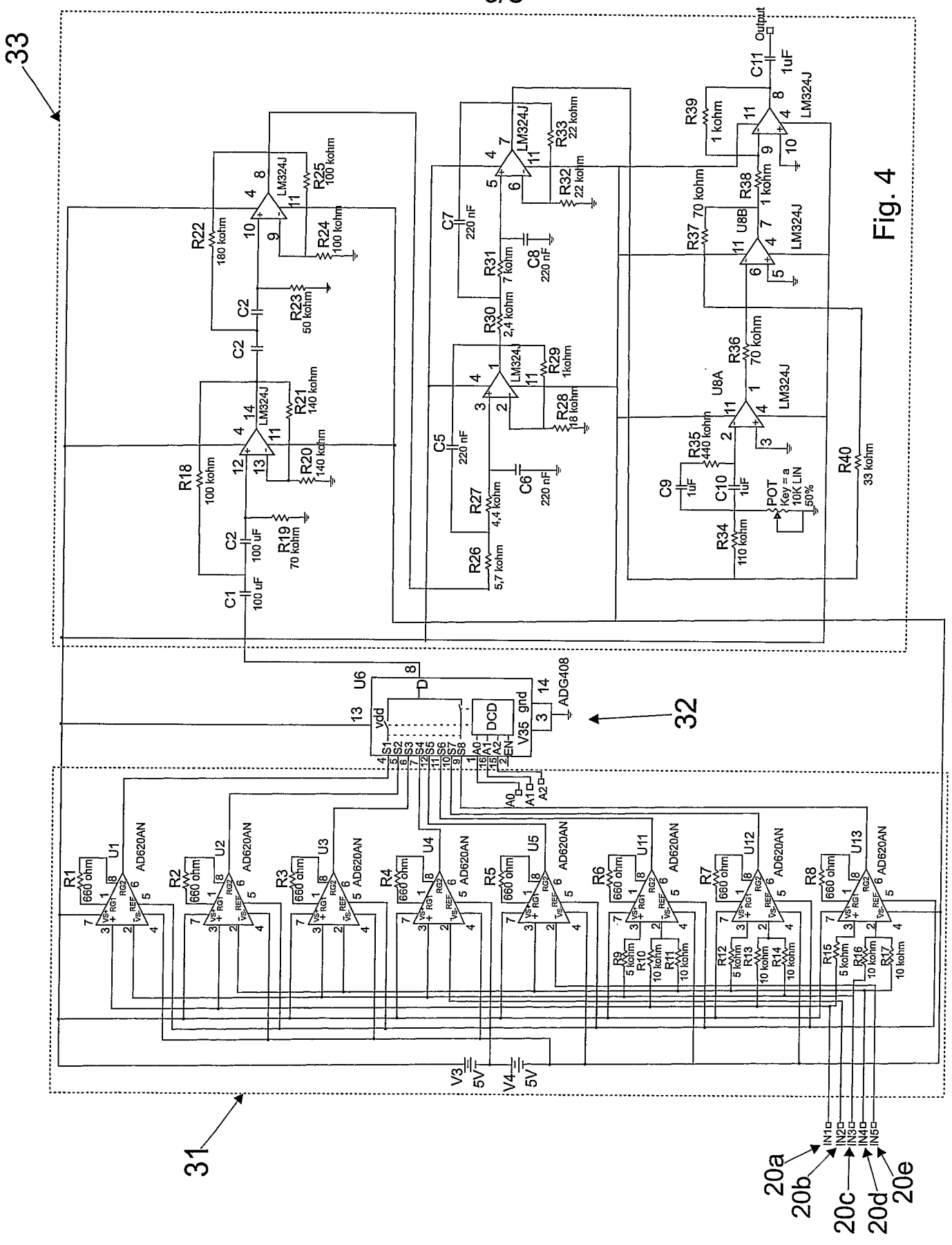
33
31
32
Output
C11 1uF
LM324J
R39 1 kohm
R38 1 kohm
R37 70 kohm
U8B
R36 70 kohm
U8A
R35 440 kohm
C9 1uF
C10 1uF
POT Key = a 10K LIN 50%
R34 110 kohm
R40 33 kohm
R33 22 kohm
R32 22 kohm
C7 220 nF
C8 220 nF
R31 7 kohm
R30 2,4 kohm
R29 1kohm
R28 18 kohm
C5 220 nF
C6 220 nF
R27 4,4 kohm
R26 5,7 kohm
R22 180 kohm
R25 100 kohm
R24 100 kohm
R23 50 kohm
C2
R21 140 kohm
R20 140 kohm
R18 100 kohm
C2 100 uF
R19 70 kohm
C1 100 uF
U6
ADG408
DCD
vdd
gnd
V35
D
S1 S2 S3 S4 S5 S6 S7 S8
A0 A1 A2 EN
U1 U2 U3 U4 U5 U11 U12 U13
AD620AN
R1 R2 R3 R4 R5 R6 R7 R8
660 ohm
R9 R10 R11 R12 R13 R14 R15 R16 R17
5 kohm
10 kohm
V3 5V
V4 5V
IN1 IN2 IN3 IN4 IN5
20a 20b 20c 20d 20e

Fig. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/BR2007/000014

A. CLASSIFICATION, OF SUBJECT MATTER
INV. A61B5/0408
ADD. A61B5/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	figures IA-C ,6A-D ,8, 11 paragraph [0072] - paragraph [0089] paragraph [0096]	11,13,17
X	WO 02/089667 A (KROECKER STEPHAN V [US]; TELZUIT TECHNOLOGIES INC [US]) 14 November 2002 (2002-11-14) figures 1,3 page 4 , line 29 - page 6 , line 24	1,5,6

-/-

[X] Further documents are listed in the continuation of Box C

[X] See patent family annex

* Special categories of cited documents

[1]A[1] document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

[1]P[1] document published prior to the International filing date but later than the priority date claimed

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"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&[1] document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27 Apri l **2007**	09/05/2007

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P B 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel (+31-70) 340-2040, Tx 31 651 epo nl, Fax (+31-70) 340-3016	Lie βmann , **Frank**

INTERNATIONAL SEARCH REPORT

International application No
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